PROACT FACT SHEET

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Natural Attenuation

Introduction

The Air Force developed a specific Environmental Restoration Program to identify, investigate, and cleanup environmental contamination associated with past activities. There are various technologies available to address remediation of contaminated sites, which are both effective and affordable. One such remediation method is natural attenuation.

Natural attenuation employs naturally occurring biological, chemical, and physical processes to reduce environmental contaminants in soils and groundwater. This passive, non-invasive remediation method effectively diminishes inorganic and organic contaminants, notably petroleum based compounds. However, natural attenuation is not the same as a "No Action" alternative; this method requires extensive, long-term site monitoring to ensure it is achieving established remediation goals.

Natural Process

The processes that contribute to natural attenuation through the destruction, stabilization, and transformation of inorganic and organic compounds are all present to some extent in the environment.

- ***Biodegradation or bioremediation*** - the break down of environmental contaminants by soil microorganisms.
- ***Dilution*** - the lowering of contaminant concentrations as the contaminants migrate away from the source.
- ***Dispersion*** - the lowering of contaminant concentrations as contaminants are scattered away from the source.
- ***Absorption or adsorption*** - the reduction of environmental contaminants due to contaminant incorporation and adhesion to soil particles.
- ***Volatilization*** - the reduction of environmental contaminants through vaporization or evaporation into the atmosphere.
- ***Chemical Transformation*** - the break down of contaminants through a series of naturally occurring chemical reactions.

Site Evaluation

Monitored natural attenuation (MNA) is not a suitable remediation method for all contaminated sites. However, it is a means of addressing contamination under a limited set of circumstances depending on site-specific data such as type, concentration, and interaction of contaminants and the biological, chemical, and physical characteristics of the site.

The U.S. Environmental Protection Agency (EPA) established three "lines of evidence," one or more of which must be met, to indicate a site provides favorable conditions for MNA.

Lines of Evidence

- Historical groundwater and/or soil chemistry data may be used to demonstrate that a clear and meaningful trend of decreasing contaminant mass and/or concentration has been observed over time at appropriate monitoring or sampling points.
- Hydrogeologic and geochemical modeling data can be used to demonstrate indirectly the type(s) of natural attenuation processes active at the site and the rate at which such processes will reduce contaminant concentrations to required levels.
- Data from field or microcosm studies (conducted in or with actual contaminated site media) may be used to directly demonstrate the occurrence of a particular natural attenuation process at the site and its ability to degrade the contaminants of concern.

Contaminants

Depending on site-specific characteristics, monitored natural attenuation may be used on a variety of contaminants including chlorinated solvents, petroleum

based products/fuels, and some pesticides. In addition, this method can be combined with other environmental remediation technologies to address all contaminants at a site.

Monitoring

Where MNA is applicable, long-term monitoring must be conducted until the contaminants are no longer a threat to human health or the environment. The relatively slow progression of natural attenuation requires long-term monitoring to ensure that natural attenuation processes are performing as predicted and meeting established remediation goals.

Monitoring is conducted at frequencies to determine current site conditions, detecting changes in plume migration, resulting degradation byproducts, and increased risks to human health or the environment. In addition, long-term monitoring ascertains geochemical, hydro-geological, and microbiological changes that may decrease the progression rate of natural attenuation. If monitoring indicates natural attenuation is not working sufficiently to achieve established remediation goals within the set timeframe, then a more "active" remedial technology may be required to supplement natural attenuation and meet site remediation objectives.

Advantage & Limitations

MNA may have substantial advantages over more active remediation technologies; however, there are some limitations which need to be considered during site assessment and evaluation.

Advantages

- Generates less remediation waste, reduces exposure, and limits environmental disturbance.
- Can be the sole restoration alternative or utilized in conjunction with more active technologies.
- Has the potential to reduce remediation costs compared to more active remediation technologies.

Limitations

- May require a longer time frame to achieve established remediation goals.
- Site evaluation is often complex and costly.
- Site characteristics might change over time, which may require the implementation of a more active remediation method.
- Required long-term monitoring might become more extensive over time. *(Adapted from OSWER, EPA, Directive 9200.4-17P)*

Additional Information...

- Contact PROACT at DSN 240-4240 or visit us at http://www.afcee.brooks.af.mil/pro-act/PRO-ACThome.asp.
- The Environmental Restoration Division, Air Force Center for Environmental Excellence (HQ AFCEE/ER), DSN 240-3383 or http://www.afcee.brooks.af.mil/.
- The Office of Solid Waste and Emergency Response (OSWER), EPA, hosts a MNA website containing federal policy and technical guidance at http://www.epa.gov/swerust1/oswermna/index.htm.
- The Technology Innovation Office, EPA, website which provides information on remediation treatment technologies at http://www.epa.gov/tio/.

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